Infection of Atlantic salmon (Salmo salar) by Moritella viscosa induces quality related markers in the musculature

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Infection of Atlantic salmon (*Salmo salar*) by *Moritella viscosa* induces quality related markers in the musculature

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Introduction

Many parameters influence the quality of the fish meat (Ashley, 2007; Poli et al., 2005). Several examples seem to indicate that disease may have an impact of the fish meat quality after recovery (MacKinnon, 1997; Salte et al., 1994). In this study Atlantic salmon infected by the gram-negative bacterium *Moritella viscosa* were used to examine this further. *Moritella viscosa* comprise a huge problem for farmed salmonid fish during cold periods and is the main aetiological agent of winter ulcers in Norway (Lunder et al., 1995). Infection by *M. viscosa* causes excessive development of punctual lesions in the musculature of the fish, which can cover large parts of the body. Infected fish are able to recover and regenerate new skin despite previously heavy wounding. Regardless of surface/skin recovery, the underlying musculature can become permanently affected and fillets from formerly infected fish are usually downgraded in quality at slaughter. The quality downgrade is possibly related to deposition of connective tissue (scarring) during tissue regeneration. The aim of the study was to examine the expression of quality related markers in the muscle tissue of Atlantic salmon (*Salmo salar*) post-smolts following infection using real-time QPCR. These were molecules involved in the immune responses against the pathogen and molecules responsible for scarring.

Methods and results

Unvaccinated Atlantic salmon smolts with a size of 80-110 g were bath-challenged using *Moritella viscosa*. Mortality was initiated three days post challenge and continued until day 13 post challenge. Open ulcers appeared in some fish on day 4 post challenge. Muscle tissue was sampled from infected and non-infected control fish 4, 7 and 14 days post challenge. In order to examine if the tissue responses were local or systemic two samples were taken from single infected fish; one sample from visibly ulcerated tissue and one additional sample from visibly non-ulcerated tissue. The samples were then subject to real-time QPCR for examining the expression of the genes coding for immunological molecules (removal of pathogens and destruction of infected cells) and scarring / deposition of collagen. Selected results are shown in figure 1.

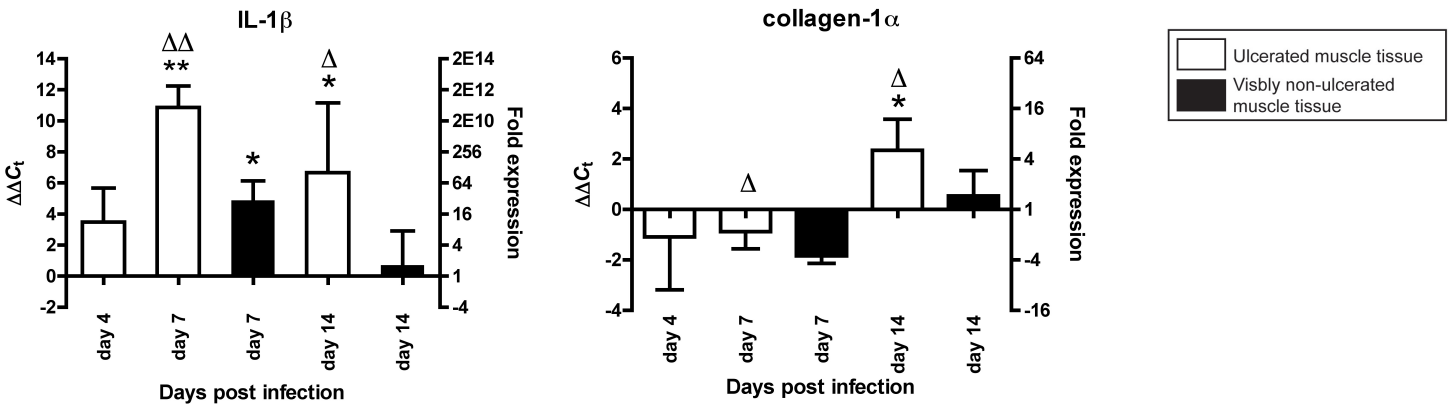

Figure 1. Expression of the genes interleukin-1β (IL-1β) and collagen-1α. The results show that the immune system is activated following infection by *Moritella viscosa*. Further, collagen synthesis is promoted in infected fish, which could explain the observed scarring following infection by *M. viscosa* in the field. The responses were localised to the visibly ulcerated areas of the infected fish indicating that quality-related changes following infection may be localised to these sites.

Conclusions

Infection of Atlantic salmon by *Moritella viscosa* induced markers associated with quality changes. Molecules taking part in the immune response against the bacterium and clean up of dead and infected cells along with molecules responsible for deposition of collagen were induced. The responses were localised to visibly ulcerated sites on the infected fish. The results are thus in accordance with findings from the field where scarring is observed from previously observed wounds and slaughtered fish are sold at a lower price due to quality downgrading.

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References

Ashley, P. J. (2007). Fish welfare: Current issues in aquaculture. *Applied Animal Behaviour Science* **104**, 199-235.

Lunder, T., Evensen, O., Holstad, G. and Hastein, T. (1995). Winter Ulcer in the Atlantic Salmon Salmo-Salar - Pathological and Bacteriological Investigations and Transmission Experiments. *Diseases of Aquatic Organisms* **23**, 39-49.

MacKinnon, B. M. (1997). Sea lice: a review. *World Aquaculture* **28**, 5-10.

Poli, B. M., Parisi, G., Scappini, F. and Zampacavallo, G. (2005). Fish welfare and quality as affected by pre-slaughter and slaughter management. *Aquaculture International* **13**, 29-49.

Salte, R., Rorvik, K. A., Reed, E. and Norberg, K. (1994). Winter Ulcers of the Skin in Atlantic Salmon, *Salmo-Salar* L - Pathogenesis and Possible Etiology. *Journal of Fish Diseases* **17**, 661-665.